EXPLOSIVES SAFETY BULLETIN

U.S. Army Technical Center for Explosives Safety (USATCES)
McAlester, OK 74501

March 2007

IN MEMORY OF
JAMES Q. WHEELER
JULY 1, 1950 — FEBRUARY 5, 2007

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James (Jim) Q. Wheeler, director of the US Army Defense Ammunition Center (DAC) and US Army Technical Center for Explosives Safety (USATCES) since 1998, passed away February 5 at his home in Broken Arrow, OK. As the DAC/USATCES director, he was responsible for executing the organization's mission, which is to support the joint ammunition community worldwide through engineering, logistics, training, safety, demil technology and technical assistance. As a senior ammunition logistician, Mr. Wheeler also managed the execution of the Quality Assurance Specialist (Ammunition Surveillance) (QASAS) and Ammunition Management programs, which, combined, provide over 1,000 civilian careerists to the field worldwide.

James (Jim) Q. Wheeler

Mr. Wheeler was a 1972 graduate of Southwest Missouri State University and earned his Master of Science degree in December 2005 from East Central University in Ada, OK. He entered federal service in 1979 as a QASAS intern at DAC and his initial assignment was at the Savanna Army Depot (SVAD). He became general foreman at SVAD, where he managed all depot ammunition life cycle operations. He later worked at both the Army materiel Command and the Joint Munitions Command. During this period, he gained extensive hands-on experience in ammunition logistics, safety and operations in depots, plants, Air Force bomb dumps, Navy, Marine Corps and Army ammunition supply points.

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IN THIS ISSUE:

Mr. Wheeler successfully led the 1995 Base Realignment and Closure (BRAC) of DAC from Savanna, IL. to its present location in McAlester, OK. He actively served as a chairman and participant in numerous joint service ammunition groups, developing ammunition policies and R&D programs with government, industry and academia on a global scale. Mr. Wheeler was an active member of the Association of the United States Army and National Defense Industrial Association.

Throughout his exemplary career, Mr. Wheeler received the Department of the Army Meritorious Civilian Service Award, the Joint Logistics Commanders Certificate of Merit, and the NDIA Citation for Exceptional Service in support of national defense. He also received the Ammunition Manager of the Year in 1995. At the time of his death, he was serving as the Functional Chief Representative of the QASAS Career Program 20 and was a charter member of the Ammunition Manager Career Program 33.

The DAC/USATCES employees and their families will miss the leadership and vision Mr. Wheeler provided, but will be steadfast in our efforts to continue the excellence and customer support he instilled in all of us.

ACCOUNTABILITY OF SENSITIVE ITEMS

The loss of accountability of ammunition and explosives (A&E) can have disastrous consequences. For example, a soldier on a training range could decide to keep an explosive round and take it home as a souvenir or a "cool" thing to have and show friends. Ammunition is inherently hazardous and designed to cause destruction. While the soldier should know better than to have this at home, his children may not. They may also think it is a "cool" thing to play with. There have been several cases where children have played with military A&E and death was the result. A tragic example is in ESMAM, ID Number 19990330D01. A 12-year old son was killed while playing with a 40mm target practice round. There are several steps that must be taken to eliminate the risk of A&E getting into the hands of the public and causing injury or death.

DA Pam 710-2-1, paragraph 11-16 requires the use of appendixes J and K to determine the residue required for turn-in. For example, for 40mm ammunition, a unit has to turn in the cartridge cases of the expended rounds and the packing box. For small arms ammunition, 25mm or less, appendix K allows the use of weight factors to determine the quantity of expended rounds.

When the number of live rounds and the amount of residue turned in does not total the number of live round issues, there is a loss. This loss has to be accounted for on a DA Form 5811-R, (Certificate-Lost or Damaged, Class 5 Ammunition Items). The first LTC in the chain of command is required to sign the certificate stating that they have reviewed the evidence and do or do not agree that the loss was due to negligence, willful misconduct or deliberate unauthorized use. In some cases, this procedure has become so common place that it is signed without the thought of possible consequences. There have been cases where the unit goes to the range with a blank DA Form 5811 already signed by the LTC. This is like signing a blank check, except the results could very likely be more than monetary.

DA Pam 710-2-1, paragraph 11-14 requires additional documentation for some A&E to confirm their expenditure. For the expenditure of Category I and II items (i.e. AT4s or fragmentation grenades) and most demolition items, a DA Form 5692–R (Ammunition Consumption Certificate) is required. (The items requiring this form are also listed in DA Pam 710-2-1, appendix J) This form is signed by the Unit Range Safety Officer certifying they saw the items being consumed in training. The Unit Range Safety Officer must be a SSG or above or in certain cases, a W01 or above. These items have the potential for use in terrorist activities.

Ammunition accountability is a command and war fighter responsibility that should not be taken lightly. Army policies are in place, but they must be vigorously followed and enforced.

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Questions/Comments

The EXPLOSIVES SAFETY BULLETIN (ESB) targets the ammunition/ explosives community. Contents are not necessarily the views of or endorsed by the Department of the Army, the Department of Defense, or any other US Government agency. The editorial contents of the ESB is the responsibility of the US Army Technical Center for Explosives Safety (USATCES), McAlester, OK. Contributions are welcome. Contact information : E-mail address: bulletin@dac.army.mil. Postal address: Explosives Safety Bulletin, ATTN: SJMAC-ESM, 1 C Tree Road, Bldg 35, McAlester, OK, 74501-9053. Phone: (918) 420-8771, DSN 956-8771. Datafax: (918) 420-8503, DSN 956-8503.

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United States Army Technical Center for Explosives Safety (USATCES) Conducts Explosives Safety Site Assessments in Iraq

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The Multi-National Corps-Iraq (MNC-I) Safety Manager requested USATCES to conduct an assessment of the Army's Explosives safety posture at selected locations throughout Iraq. The USATCES team consisted of Mr. Daniel Pezzulo, Quality Assurance Specialist Ammunition Surveillance (QASAS); Mr. Jefferson Paddock, QASAS, and Mr. Ronald Thornhill, Safety Specialist.

Background

In May 2005, MNC-I directed Army installations involved in explosives storage and handling activities to align those operations within Iraq to peacetime standards. After considerable deliberations, USATCES was requested to conduct an assessment to ensure that Army forces in Iraq were able to meet explosives safety standards.

Purpose

The October 2006 through January 2007 assessment was the first of its kind for the Army during Operation Iraqi Freedom and was designed to look at fourteen Army Camps and Forward Operating Bases (FOB) throughout Iraq. The team was asked to determine compliance with explosives safety standards, and review or draft explosives licenses (as applicable). When deviations from standards were necessary, the team was asked to review or draft explosives safety waivers to address those concerns. The team assessed Explosives Ordnance Disposal (EOD) Team storage areas in addition to assessing Ammunition Holding Areas (AHA), Basic Load Ammunition Holding Areas (BLAHA), Ammunition Transfer Holding Points (ATHP) and Ammunition Supply Points (ASP).

At the first Army Camp, twenty-nine explosives licenses and two explosives safety waiver packages were completed. The licenses included two ASPs, which consisted of numerous undefined earth covered magazines, above ground MILVAN storage, issue/receipt, and ammunition maintenance pads. The explosives safety waiver packages identified standards that could not be met due to proximity of the installation boundary and on-base roads. As a result of this site visit, the Army has begun construction of a new ASP; and is consolidating the two original ASPs on this Camp. The new construction will consist of steel bin barricaded above ground MILVAN storage pads. This will result in waiver free storage of ammunition.

Above Ground MILVAN Storage Pads using Steel Bin Barricades (Armco Revetments)

The remaining 13 installations required more of the same license and waiver packages for above ground MILVAN storage, issue/receipt, and ammunition maintenance pads. The team completed 54 licenses and nine explosives safety waiver packages. Most of the waivers were due to proximity of installation boundary, on-base roads, some encroachment due to security concerns, and limited real estate.

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IRAQ

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Above Ground MILVAN Storage Pad in Iraq using HESCO Concertainer Barricades

In addition to completing the site licenses and waiver packages, the team developed various types of storage schemes to optimize operations and also provided explosives safety training as requested. Further, explanations regarding the relative risks to personnel and equipment in areas surrounding ammunition operations were presented and discussed at command levels at each activity.

Mr. Jeff Paddock conducting one-on-one explosives safety training.

During contingency operations, a thorough risk analysis of explosives storage areas and surrounding Quantity-Distance (QD) Safety Arcs is required. Security concerns and limited real estate may create situations where proper QD cannot be observed. It is important to optimize explosives storage and operation locations. The use of properly constructed and designed barricades assist in increasing the site's Net Explosive Weight (NEW) without sacrificing explosives safety to the site and surrounding area. Recommendations made by the team resulted in several sites considering reconfiguration of AHAs, BLAHAs, ATHPs, and ASPs to enhance their overall storage capacity and explosives safety posture.

Typical ATHP in Iraq

Summary

Over the course of 120 days, the USATCES Team visited 14 major Army Camps and FOBs. All locations were provided guidance to improve their explosives safety posture. A thorough review of existing licenses and waivers was conducted and when licenses were not available, the team drafted licenses for the installation. Further, the team provided guidance in proper barricade construction and offered alternative barricading schemes when internal quantity distances were inadequate for operational requirements.

Major explosives safety challenges remain in Iraq. In order to enhance explosives safety measures throughout the theater of operations, activities must complete thorough risk assessments which identify benefits and risks to ensure commanders fully understand the hazards involved with storing and handling ammunition within their respective areas.

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Questions/Comments

Explosives Safety Considerations in Deployments

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LACK OF SPACE

Often times when a unit deploys, the ammunition storage and handling areas have already been established. An ammunition storage and handling area's accountable officer is one of the persons responsible to ensure these areas comply with explosive safety standards outlined in DA Pam 385-64 and DoD 6055-9 STD. Just because the ammunition storage area was established prior to your arrival, if it is not within standards, correct the deficiencies and/or inform leadership. Ensure there is adequate separation distances between stacks of ammunition and Inhabited Buildings (IB) (including installation boundaries), installation roads or Public Traffic Routes (PTR), explosives operations referred to as Intraline (IL), and other stacks of ammunition (Intermagazine (IM)). At Forward Operating Bases (FOBs) continually evaluate the cardinal explosives safety principal, "Limit exposure to a minimum number of people, for a minimum amount of time, to the minimum quantity of ammunition and explosives consistent with safe and efficient operations." Ammunition quantities tend to grow under the premise that more is better.

THINGS TO KNOW

The ammunition experts are the Ammunition Warrant Officers, Senior Non-Commissioned Officers and ammunition handling crews. Don't expect senior leadership to know or understand Quantity Distance (QD) arcs. If they do, it is a plus. You are the expert, so keep that in mind when you raise concerns in the chain of command. If your storage area is not within standards, inform the chain of command. Know your facts, provide the information required, and make recommendations. The DA Pam and DoD Standard are your bibles; READ THEM. If there are questions, contact AMMO HELP at the Defense Ammunition Center; the help desk will usually respond within 24 hours.

Typically in Iraq and Afghanistan, real estate is at a premium. FOBs do not generally have a lot of room to store ammunition. The first consideration should be what ammunition is actually needed. Do not rely solely on the unit's Ammunition Basic Load (ABL). Face it, if 155mm artillery is not being used, there is little need for that ammunition; consider the risk and benefits. Generally, this is a small arms war. Second, consider the infrastructure of the FOB. What is there room to store? Third, if space is a concern, larger quantities of high explosives may be remedied by using the logistics chain: look at the time line. If all else fails, consider getting a waiver after you've assessed the risk. Risk assessments should consider the loss of personnel and assets and shall be approved at the appropriate levels, usually a General Officer.

If a correct assessment is accomplished, typically, the bulk of required ammunition will be Hazard Division (HD) 1.3 and 1.4. A minimum of 100 feet separation from ammunition storage areas and IB and PTR to installation roads is required. A minimum of 50 feet from IL and IM distances and 75 feet if the storage structure is constructed of combustible material is required. With these distances, up to 1,000 pounds Net Explosive Weight (NEW) of HD 1.3 and Mission Essential Quantities (MEQ) of HD 1.4 can be safely stored on each storage pad. Additional detailed information can be obtained from Tables C9.T13 or C9.T14 in the DoD Standard and Tables 5-16 or 5-17 in the DA Pam.

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Considerations

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Undoubtedly, there will be a need to store some HD 1.2 ammunition. A minimum distance required is 200 feet separation for HD 1.2.1 with a Maximum Creditable Event (MCE) of ≤100 lbs and 100 feet separation for HD 1.2.2 for IB, PTR, IL and IM distances. Consider the requirements carefully; as NEW increases, so does the required separation distance. See Tables C9.T8, 9, 10 and 11 for more details.

Is there a real need to have HD 1.1? This HD requires a great deal of real estate to safety store this division of ammunition. Typically, the requirement is 1,250 feet to store HD 1.1 in quantities of 450 to 30,000 lbs. NEW for IB distances, 750 feet for PTR distances and 60% of IBD for on-base roads. Specifics are contained in Table C9.T1 of the DoD Standard. Some relief can be obtained from Table C9.T2 for quantities less than 450 lbs. NEW.
CAUTION: Be familiar with the limitations in the paragraphs in chapter 9 of the DoD Standard that directs you to this table. Table C9.T5 provides IL distances for HD 1.1 and Tables C9.T6, 7A and 7B provide IM distances.

BARRICADES

Barricades will reduce the internal distances (i.e. IL and IM) required, normally by half, but does little to reduce the external distances of IB, PTR and on-base roads. Earthen berms, HESCO Concertainers, and Steel Bins are typical means of

barricading ammunition. T-Walls, Alaska, Texas, and Jersey barriers are not considered barricades. These concrete barriers may in fact contribute to the fragment debris in case of a catastrophic event.

CAN'T LIVE WITH THAT

Chapter 10 of the DoD Standard and Chapter 14 in the DA Pam provide some relief for internal distances; again it does little to reduce external exposures. Table C10.T1 provides distances required for a Basic Load Ammunition Holding Area (BLAHA) or Basic Load Storage Area (BLSA). Using the HESCO Barricade Scheme published in the Explosive Safety Bulletin, Special Edition Barricading Guide, dated October 2006, a reduction of internal footprint can be accomplished; however, there is an 8,800 lbs. NEW limitation per pad. Normal mixing rules do not apply.

If there are additional issues or concerns with proper QD arcs, contact AMMO HELP. They will not be able to make the FOB grow, but can provide ideas to minimize risk and preserve assets. **DO THE RIGHT THING.** Assess the risks and inform the chain of command when something is not right. Explosives and ammunition are not discriminating.

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Determining Safe Separation Distance from Transmitters and Ammunition

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Equivalent Isotropic Radiated Power (EIRP) also known as Effective Isotropic Radiated Power (EIRP) is the amount of power emitted from an isotropic antenna to produce the power needed to send the signal to a receiver. Usually harmless to people, EIRP can cause ammunition and explosives that are sensitive to electro-magnetic radiation (EMR) to function and detonate. Common munitions initiated electronically are fuzes, detonators, blasting caps, rockets (AT-4) and missiles, and some shape charges (RPGs).

A lot of big words, but we use the equipment daily. An isotropic antenna transmits a signal in all directions (omni-directional). They are common on hand-held radios, cell phones, and vehicles. If you can talk on it, receive data, or find information from another source, it is most likely a transmitter and produces EIRP.

If a transmitter sends on a low frequency and uses a lot of power, it produces a large amount of EIRP and can initiate those munitions that are sensitive to EMR at a great distance. If a transmitter sends on a high frequency and does not use a lot of power, it produces a smaller amount of EIRP and reduces the distance that EMR can detonate munitions. You do not have to push a button or dial a phone to produce EIRP. Some devices will automatically answer an incoming signal.

The bottom line is that you need to find out how much EIRP is emitted from your transmitters. If it has an antenna, it can transmit. Demand that manufacturers and retailers provide the specification sheets that state the amount of EIRP generated. Using the Safe Separation Distance (SSD) matrix (on the next page), find the intersection where the frequency you are using and the EIRP meet. The number in the intersection is the maximum distance in feet that you must stay away from ammunition and explosives to use the transmitter. Keep the devices at least that far from munitions … establish SOPs, post signs, prohibit items in the area … have positive control. If you cannot establish the EIRP for a specific transmitter, restrict the use of the device within 100 feet of ammunition and explosives.

As always, if you need assistance in determining the safe separation distance or if munitions are initiated electronically, contact the US Army Technical Center for Explosives Safety.

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Questions/Comments

See SSD matrix on page 8

Safe Separation Distance (SSD) Calculations for Hand-held Radios (in Feet)

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Safe Separation Distance (SSD) Calculations for Hand-held Radios													
Frequency	Equivalent Isotropic Radiated Power (in Watts)												
(in MHz)	**0.025**	**0.05**	**0.1**	**0.25**	**0.5**	**0.75**	**1**	**2**	**3**	**4**	**5**	**10**	**50**
HF Radios 1.6 - 60	**0**	**8**	**11**	**18**	**25**	**31**	**36**	**51**	**62**	**72**	**80**	**114**	**255**
VHF LOW Radios 30 – 90	**0**	**8**	**11**	**18**	**25**	**31**	**36**	**51**	**62**	**72**	**80**	**114**	**255**
VHF HIGH Radios 90 – 225	**0**	**7**	**10**	**16**	**23**	**28**	**32**	**45**	**55**	**64**	**71**	**101**	**226**
UHF Radios 225 – 512	**0**	**3**	**4**	**6**	**9**	**11**	**13**	**18**	**22**	**26**	**29**	**40**	**90**
UHF "700" (764-767, 773-797)	**0**	**1**	**1**	**2**	**3**	**4**	**4**	**6**	**7**	**8**	**9**	**13**	**29**
UHF "800" (803-806, 806-824, 851-870)	**0**	**1**	**1**	**2**	**3**	**3**	**4**	**5**	**6**	**7**	**8**	**11**	**25**

The intersection of the Frequency and EIRP is the SSD for using hand-held radios in the vicinity of ammunition and explosives (AE). The AE is assumed to be unshielded from the effects of electro-magnetic radiation (EMR). Even if designated as shielded from the manufacturer, packaging and protective measures may have been damaged or compromised during storage, transportation, or use.

The Equivalent Isotropic Radiated Power (EIRP) is the amount of power emitted by an isotropic antenna (common to hand-held or vehicle radios) to produce the peak power density observed in the direction of maximum antenna gain. If the "Specifications" document for the hand-held radio does not list the EIRP in the "transmitter" section, contact the manufacturer and request the EIRP.

Use this table to calculate SSD for Global positioning systems (GPS), wireless laptops, and other devices containing transmitters.

Cell phones will not be used inside a facility containing AE or within 10 feet of AE in an outdoor environment.

Use Table 6-4 of DA Pam 385-64 to calculate SSD for antennas that transmit a signal directed at a specific location (a directional antenna). These antennas are normally associated with stationary transmitters and shaped (i.e. dish) to direct the path of the signal.

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Questions/Comments

LESSONS LEARNED

Accident Prevention Reminder -- Use of Guidance in Technical References during Training

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In November 2006, a soldier was undergoing weapons familiarization training with the M203 40mm grenade launcher, firing Cartridge, 40mm, HEDP, M433 (DODAC 1310-B546) at a distant target. Due to unfamiliarity with the launcher, the soldier aimed it too low, at a position on the ground near the front of the weapon. Upon firing, the round struck the ground and functioned. Shrapnel from the functioning of the round injured a nearby soldier, who required evacuation and surgery.

Training with live ammunition, especially under theater conditions, requires the exercise of special care in the observance of all applicable safety precautions and procedures pertaining to both the weapon and the type of ammunition involved. This is particularly true if the user does not have prior experience with either or both of those areas. While familiarization training is a necessary step in the use of any weapon or ammunition item that is new to the user, strict attention to published guidance is of great importance, since practices acquired during this training will form the basis for future safe and effective use. (In the specific case of the M203 grenade launcher, this guidance can be found in Paragraph 5-1b of FM 3-22.31, and in Chapter 2 of TM 9-1010-221-10.)

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Questions/Comments

— BARRICADES —
Little Changes Can Have Drastic Effects!!!

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Current DoD and Army explosives safety regulations require the height of a barricade to be 2 degrees above the stacks of ammunition when drawn from the rear of the stacks. During the review of a site plan for the Theater Storage Area (TSA) in Camp Arifjan, Kuwait, the 720 foot long ammunition storage pads indicated the requirement for a 36 foot tall barricade. The TSA had 25 of these barricaded ammunition storage pads with approximately 12 foot high barricades as shown in the picture below. Our question became, Do we really need a 36 foot high barricade to adequately protect adjacent ammunition storage sites that are 477 feet apart? This caused us to question the safety basis of this requirement.

As we started the research of this requirement, there were several questions we wanted to address as follows:

1) Why do we have a 2 degree rule for barricades?
2) What is the actual basis for the 2 degree rule and what additional degree of safety does it really provide?
3) Does the 2 degree rule apply equally for large ammunition storage pads?
4) What science or technology supported the adoption of the 2 degree rule?

To perform the research and analysis of the barricade height requirement, DAC/USATCES enlisted the assistance of the US Army Corps of Engineers-Huntsville Division. After extensive research, it was learned the 2 degree rule was adopted following US Air Force tests conducted in the 1970s of small storage modules and was not an important parameter of the testing. This lack of definitive barricade height science, led to our development of the worst case expected fragments from an accidental explosion and the conduct of a series of trajectory analysis using approved software models.

The results of the trajectory analysis showed that barricades with a height of one foot above the line of site between two ammunition stacks will provide the prevention of prompt propagation intended from a barricade. This means two 8-foot stacks of ammunition only need a 9-foot high barricade to prevent prompt propagation, which is essentially the same level of safety the previously required 36-foot high barricade from the example above would provide.

At this point, all the Services and Department of Defense Explosives Safety Board have voted in favor of this change and it is being incorporated into DoD and Army policy. Subsequently, additional barricaded open ammunition storage areas in Iraq and Afghanistan will be positively affected by this change. Amazingly, an estimated $67M in cost avoidance over the next three years will be achieved through reduction in size of the barricades, materials and labor required, and reduced footprint of the barricades.

Barricaded Ammunition Storage Pad at Theater Storage Area-Camp Arifjan, Kuwait

The lessons we learned from this project and study are:

1) Don't accept status quo….ask questions.
2) Use Lean Six Sigma and Value Engineering principles and tools.
3) Make technology work for us.
4) Evaluate other explosives safety regulations and ensure the requirements are based on sound science and technology.

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Questions/Comments

POLICY AND REGULATION CHANGES

Status on Revision of the DA Pamphlet 385-64

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As most of you are probably aware, the DA Pam 385-64, *Ammunition and Explosives Safety Standards*, has been undergoing review for some time now. We are in the home stretch with the draft publication entering the final phases of the review, approval and publishing process.

On January 19, 2007, a call for review of the final draft was initiated by the Office of the Director of Army Safety (ODASAF). Comments and suggested improvements were due to ODASAF on 19 February 2007. The comments and suggested improvements are being worked and once completed, will receive final Army staffing.

Once completed, the finalized manuscript will be sent to the US Army Publishing Agency (USAPA). The USAPA process involves editorial review, prepress preparation, Office of the Judge Advocate General (OTJAG) legal review, and final coordination with the ODASAF before publication. We are hopeful that the process will result in a completed product before the end of this fiscal year.

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Questions/Comments

The 28th Department of Army Explosives Safety Council is tentatively scheduled for 5-7 June 2007. If you have suggested topics for this meeting, please contact your MACOM Safety Office.

FREQUENTLY ASKED QUESTIONS

Q Where can I get explosives safety videos to use for training?

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A There are a couple good sources for this. The Defense Automated Visual Information System (DAVIS)(http://dodimagery.afis.osd.mil/davis/) contains the searchable listings and descriptions of thousands of audiovisual (AV) productions and interactive multimedia instruction (IMI) products used by the Department of Defense (DoD). You can probably find what you need at this site. If you are looking for safety videos and related materials concentrating on the hazards of unexploded ordnance (UXO), you can downloaded them from the Defense Environmental and Information Exchange (DENIX) public education web site (https://www.denix.osd.mil/denix/Public/Library/Explosives/UXOSafety/learning.html).

Q Can a metal probe be used to measure earth-cover depth on earth-covered magazines (ECM)?

A The simple answer is yes, however, a probe used carelessly could and has damaged the waterproofing membrane. Use of a probe is not advisable due to potential for damaging the integrity of the waterproofing.

Various materials are used for the waterproofing membrane depending on the construction drawing used and the amended versions applied by the installations at time of construction. Some waterproofing methods are more resistant to damage from a probe than others. If you use a probe, be sure you know the membrane construction materials and use the probe accordingly.

Preferred alternatives to using a probe to measure earth-cover depth are:

Method 1:

Step 1: Using construction drawings for each earth-covered magazine (ECM), determine the distance from the top of the arch to the top of the headwall and record distance on worksheet. The drawing on the next page provides generic points of reference for an ECM, but is not intended to be indicative of any specific ECM design.

Step 2: Measure directly behind the headwall the distance between the earth cover and the top of the headwall. Subtract this distance from the distance acquired in step 1. This will be the depth of the earth cover at the headwall.

Step 3: Determine the earth-cover depth at the rear vent in the same manner as described in steps 1 and 2.

Step 4: Run a string line at a calculated distance (about 3-6 inches) above the earth cover from the headwall to the same calculated distance above the earth cover at the rear vent. The string should be taut. If the earth cover appears level along the string line from front to rear, the earth-cover depth will be determined by the head wall and rear vent measurement of steps 1-3.

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FREQUENTLY ASKED QUESTIONS

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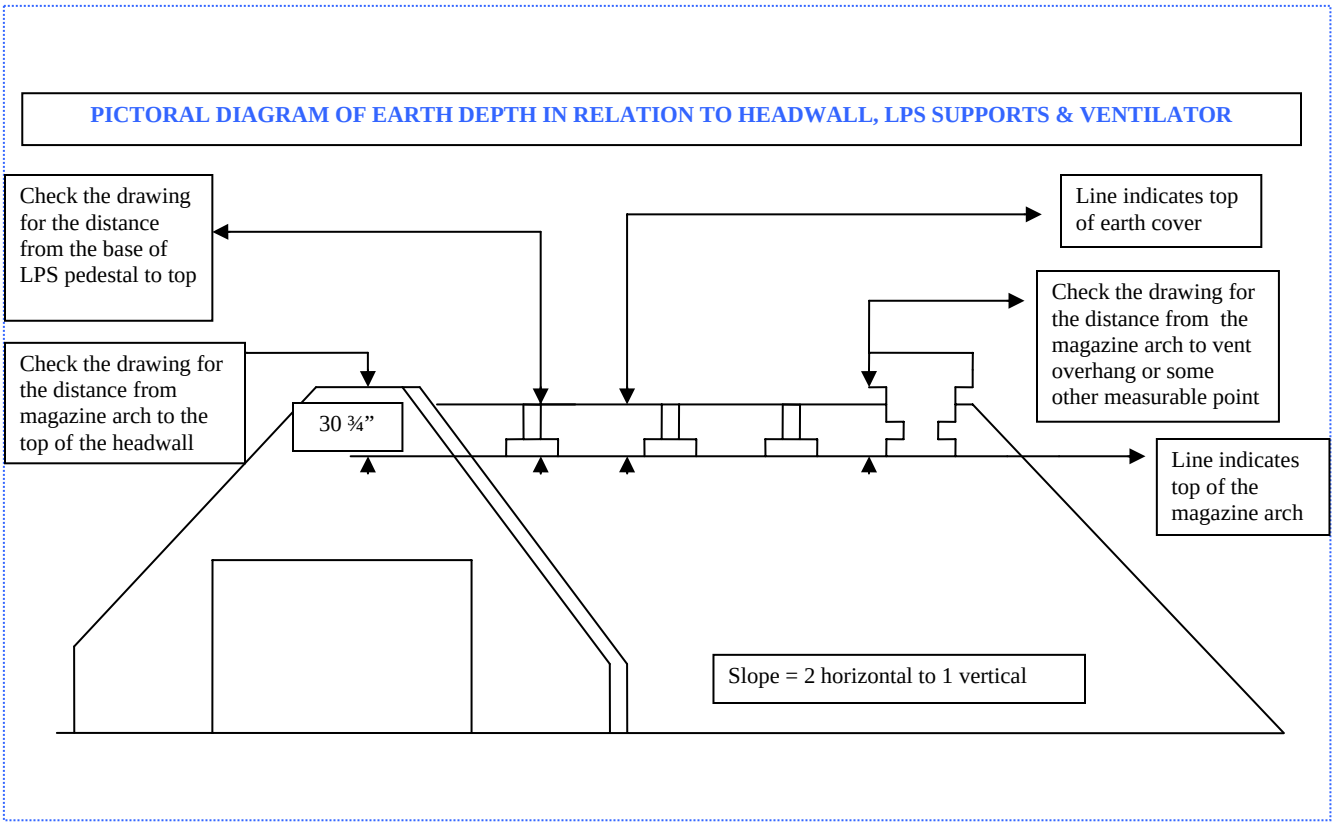
Step 5: If the earth-cover does not appear level, measure the distance from the string to the earth at the points of depression and compare to construction drawings. The shallowest depth measured will determine the depth of the earth cover.

Step 6: Determine slope of earth cover. A minimum slope of 1.5 horizontal to 1 vertical starting directly above the spring line of each arch will be maintained. For new construction each facility must have a minimum earth cover at a 2:1 or greater slope. Standing in front of the magazine (left or right side), visually scan the side of the earth cover. If the earth cover is equal to or greater than the slope of the head wall, the magazine earth cover is considered serviceable. If the earth cover is less than the slope of the head wall, the magazine earth cover will be considered unserviceable.



Method 2:

Use Ammunition Peculiar Equipment (APE) 1983, Range and Elevation Measuring Equipment. APE 1983 is essentially surveying equipment. Instructions for use should accompany the APE 1983.

Questions/Comments

USATCES APPLICATIONS

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Explosives Safety Mishap Analysis Module (ESMAM)/Joint Hazardous Classification System (JHCS) (login required). On-line databases containing explosive mishaps and final hazard classification data.

Chemical and Biological Event Reporting System (CBERS) (login required).

Webcat. On-line catalog listing collections we have, which includes technical reports, journals, archival documents, and accident reports.

Explosives Safety Bulletin. Listing of all bulletins by table of contents or full text.

Safety Policies. Listing/links to various DA Explosives and Chemical policy documents.

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Website: https://www3.dac.army.mil/es

Explosives Safety Mishap Analysis Module (ESMAM)/Joint Hazard Classification System (JHCS) database link: https://www3.dac.army.mil/esidb/login/Default.asp

Questions/Comments